

TSS463 VAN

Van Controller Serial Interface

TSS461C VAN

Van Controller

**TSS463/TSS461C
VAN Controllers
1999 January**

TEMIC SEMICONDUCTORS IS AN ATMEL COMPANY

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2. General Information

Product Name: TSS463 / TSS461C
Function: Van Controllers
Specific features: Serial Interface (TSS463)

Wafer process: Z86E

Available plastic package types: SOIC16 (TSS463), SOIC24 (TSS461C)

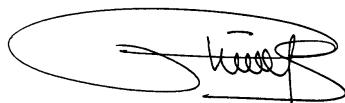
Locations:

Process, product development TEMIC Semiconductors Nantes, France
Wafer plant TEMIC Semiconductors Nantes, France
QC responsibility TEMIC Semiconductors Nantes, France
Assembly ANAM, Korea, Philippines

Probe test TEMIC Semiconductors Nantes, France
Final test GATEWAY Philippines
ANAM Korea

Quality Assurance TEMIC Semiconductors Nantes, France
Reliability testing TEMIC Semiconductors Nantes, France
Failure analysis TEMIC Semiconductors Nantes, France

Quality Assurance Management Nantes



Signed.....

3. Technology Information

3.1 Wafer Process Technology

| | |
|-------------------------|--|
| Process type (Name): | CMOS (SCMOS1/2 - Z86E) |
| Base material: | Silicon Epi substrate type |
| Wafer Thickness (final) | 475um |
| Wafer diameter | 150mm |
| Number of masks | 13 |
| Gate oxide | |
| Material | Silicon dioxide |
| Thickness | 195 A |
| Polysilicon | |
| Number of layers | 1 |
| Thickness | 3000 A |
| Metal | |
| Number of layers | 2 |
| Layer 1 material | TiN/W |
| Layer 1 thickness | 600 + 5000 A |
| Layer 2 material | Ti/AlCu |
| Layer 2 thickness | 7000 A |
| Passivation | |
| Material | Si ₃ N ₄ on SiO ₂ |
| Thickness | 10000 A |

3.2 Product Design

| | |
|--------------------------------|--------------------------------------|
| Die size (TSS463) | 11.15mm ² (3610μm*3280μm) |
| Die size (TSS461C) | 8.46mm ² (3480μm*2610μm) |
| Logic Effective channel length | 0.8μm |
| Gate poly width | 0.8μm |
| Gate poly spacing | 1.2μm |
| | |
| Metal 1 width | 1.3um |
| Metal 1 spacing | 1.5um |
| Metal 2 width | 1.6um |
| Metal 2 spacing | 1.6um |
| | |
| Contact size | 1.0μm |
| | |
| Via size | 1.4μm |

3.3 Package Technology

3.3.1 SOIC.300 16 leads

| | |
|------------------------|--|
| Package weight | 0,43 g |
| Chip separation method | Sawing |
| Lead frame | |
| Material | Cu |
| Thickness | 10 mils |
| Size | 270*270 mils ² |
| Lead plating | Electroplated Sn/Pb 85/15 |
| Die attach | |
| Material | Silver epoxy |
| Type | Ablestick 84-1 LMISR4 |
| Wire bonding | |
| Material | Gold |
| Diameter | 33um |
| Method | Thermosonic |
| Molding | |
| Material | Nitto MP8000AN |
| Flammability rating | UL94V-0 |
| Marking | |
| Method | Printed ink |
| Coding example | TEMIC <i>optional special customer marking</i> TSS463 YY MM |
| Dry packing | No |
| Tube packed | |
| Primary | Tube |
| Material | Antistatic PVC |
| Number per unit | 47 |
| Secondary | Box |
| Material | Cardboard |
| Number per unit | 1692 |
| Labelling (minimum) | Device type, Quantity, Date Code, Prod. code |
| Bar coding | Code 39 to EIA-556-A |

Tape packed

| | |
|---------------------|--|
| Primary | Tape |
| Material | Antistatic PVC |
| Number per unit | 31 |
| Secondary | Box |
| Material | Cardboard |
| Number per unit | 1116 |
| Labelling (minimum) | Device type, Quantity, Date Code, Prod. code |
| Bar coding | Code 39 to EIA-556-A |

3.3.2 Other available packages

No other package available

Dry packing

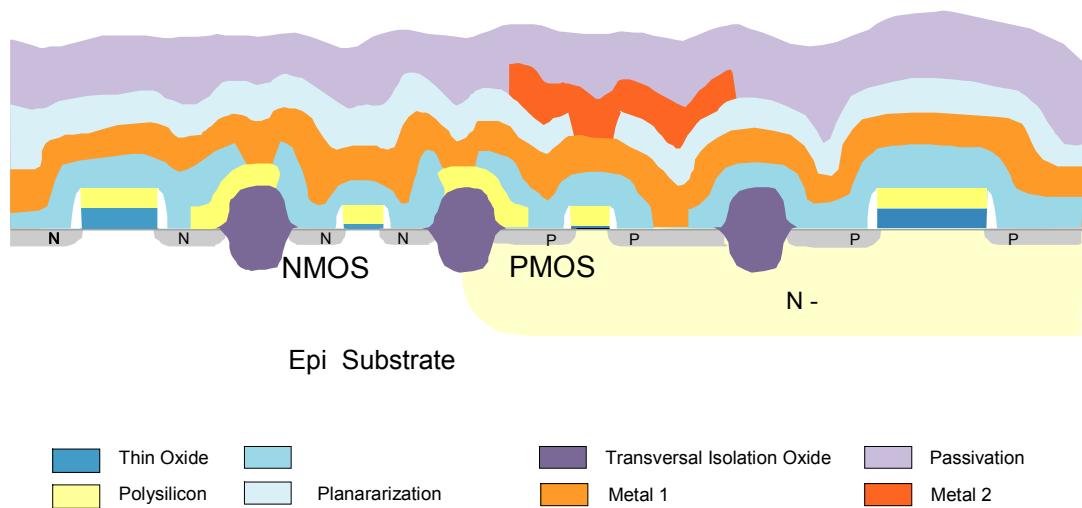
| | |
|---------|----|
| SOIC 16 | No |
| SOIC 24 | No |

3.4 Test

| | |
|-------------------|-----------|
| Probe equipment | Sentry 15 |
| Probe temperature | 125°C |

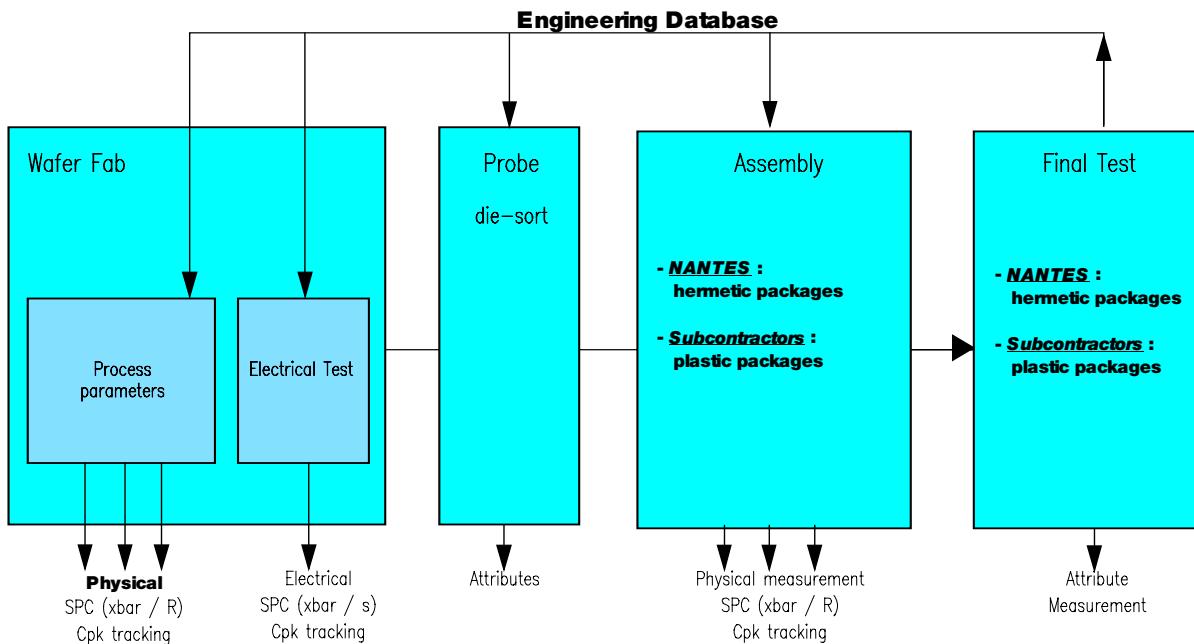
| | |
|------------------|-----------------------|
| Test equipment | Sentry 15 |
| Test temperature | 25°C, 125°C(sampling) |

3.5 Device Cross Section



3.6 Wafer Process Control

All the inspections and controls are defined as a process step in the production management software, and are led by using a centralized SPC software. PC system could be summarized as follows:



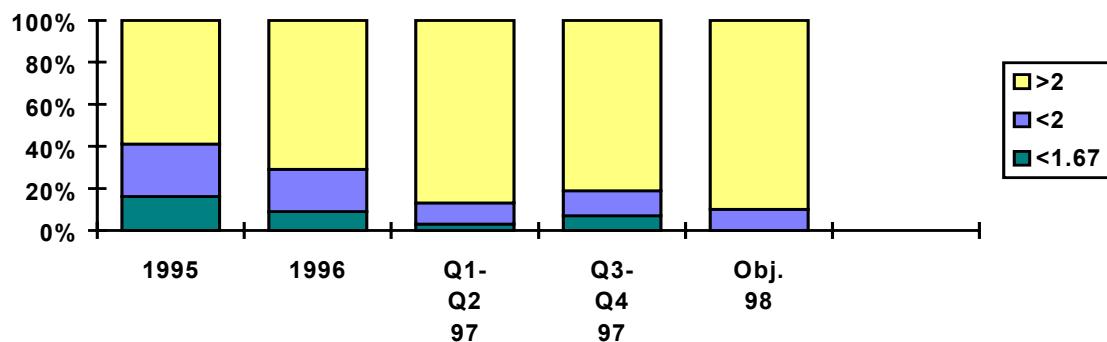
Critical process parameters are identified by using F.M.E.A. and other advanced tools.

Those parameters are followed in real time with the SPC methodology and their capability is measured and monthly reported in the Operation Review.

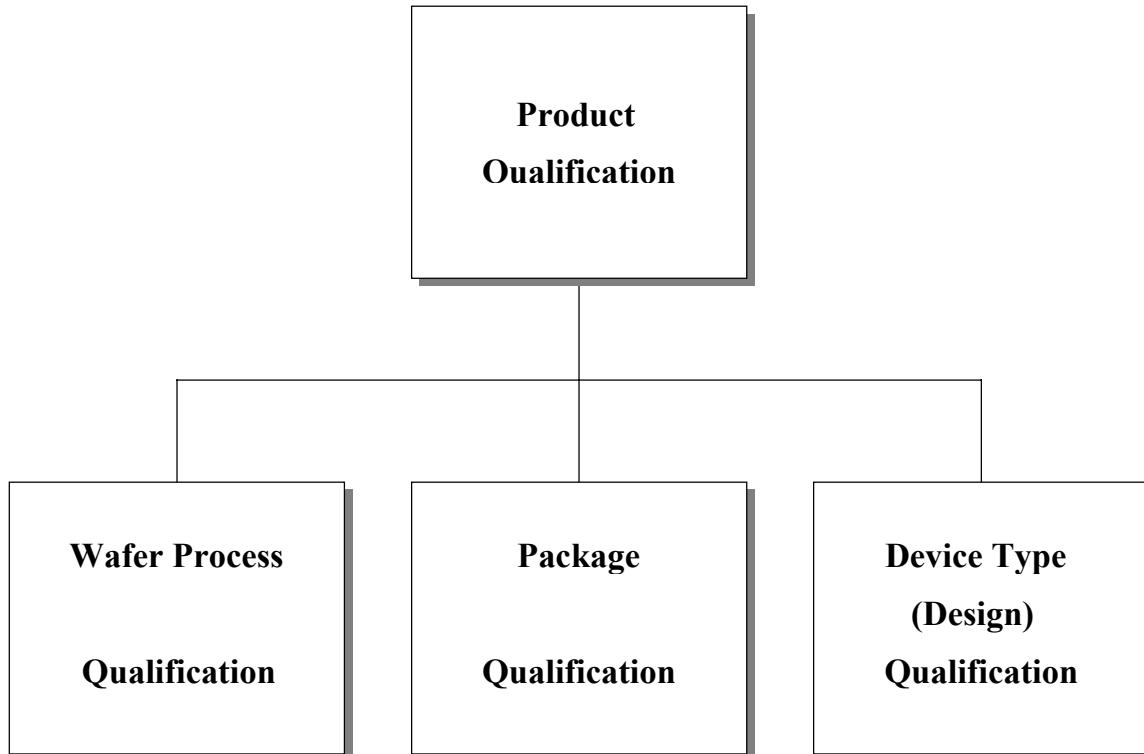
For end 1997, the Cpk target is the following :

all parameters with Cpk above 1.67

% of all Parameters per Cpk categories



4. Qualification



All product qualifications are split into three distinct steps as shown above. This same procedure is also used to qualify a change. Before a product is released for use, it must have been manufactured using a qualified wafer and package process. Before a device is released for production processing, it must also have successfully completed its required specific qualification.

The standard tests which are used for this procedure are shown in the section
"Qualification Flow"

4.1 Change Procedure

All changes are controlled by ECN (Engineering Change Notice). All major changes are notified to those customers using products which are affected by the change.

A major change is defined as a change which affects the electrical and/or mechanical specification as defined in the datasheet or which affects the following parameters as defined hereafter:

| 1 General Major Changes | |
|--------------------------------|---------------------------------------|
| 1-1 | Manufacturing line |
| 1-2 | Sequence of fabrication process cycle |
| 1-3 | Material |
| 1-4 | Electrical parameter |
| 1-5 | Dimension |
| 1-6 | Pad location |
| 1-7 | Die size |

| 2 Changes specific to wafer fabrication area | |
|---|-----------------------------|
| 2-1 | Doping process |
| 2-2 | Gate oxide formation method |
| 2-3 | Equipment change |
| 2-4 | Layer thickness |
| 2-5 | Module dimensions |

| 3 Changes specific to assembly process area | |
|--|--------------------------|
| 3-1 | Sawing process |
| 3-2 | Die attach process |
| 3-3 | Wire interconnect method |
| 3-4 | Molding process |
| 3-5 | Tinning process |

| 4 Changes specific to test area | |
|--|-------------------------|
| 4-1 | Specification limit |
| 4-2 | Test coverage reduction |
| 4-3 | Product identification |
| 4-4 | Final conditioning |

Qualpack TS80C31X2/C32X2

4.2 Qualification Flow

General Requirements for Plastic packaged CMOS IC

| Standard | Test Description | Qualification type (acceptance) |
|-------------------------------|---|--------------------------------------|
| MIL-STD 883D Method 1005 | Electrical Life Test (Early Failure Rate) 12 hours 150°C (Tj) 5.75V | Device (1/2000 12h) |
| MIL-STD 883D Method 1005 | Electrical Life Test (Latent Failure Rate) 1000 hours 150°C 5.75V Dynamic or Static | Device (0/116 500h) |
| MIL-STD 883D Method 3015.7 | Electrostatic Discharge HBM +/-2000v 1.5kOhm/100pF/3 pulses | Device (0/3 per level) |
| JEDEC 17 | Latch up 50mW power injection 125°C | Device (0/10) |
| MHS PAQA0046 | PROM Dataretention High Temperature Storage 165°C | Device (0/45 500h) |
| MIL-STD 883D Method 1010 | Temperature Cycling 1000 cycles -65°C/150°C air/air | Device and Package (0/45 500c) |
| MHS PAQA0184 | Pressure Pot after Mounting Stress 168 hours 130°C/85%RH | Device and Package (0/45 168h) |
| EIA JESD22-A101 | 85/85 Humidity Test 1000 hours 85°C/85%RH | Die and Package (0/45 500h) |
| EIA JESD22-A110 | HAST 336 hours 130°C/85%RH/5.5V | Device and Package (0/45 168h) |
| EIA JESD22-A112 | Resistance to Soldering Heat Infra Red Stress 220°C/25s/3 times | Package (0/10 per class) |
| MIL-STD 883D Method 2003 | Solderability | Package (0/3) |
| MIL-STD 883D Method 2015 | Marking Permanency | Package (0/3) |

4.3 Wafer Process Qualification

This section summarizes the global 1998 reliability results of the products manufactured with the same technology as the VAN TSS463 and TSS461C (Z86 processes).

| Wafer Process | Device Types | Test Description | Step | Result | Comment |
|---------------|--------------------------------|-----------------------|---------------|--------------------------|--|
| Z86 | Microcontrollers and dedicated | EFR Dynamic Life Test | 12h | 3/22888 | |
| | | LFR Dynamic Life Test | 500h 1000h | 1/1155 | |
| Z86 | Memory, Asic, | EFR Dynamic Life Test | 12h | 1/5209 | |
| | | LFR Dynamic Life Test | 500h 1000h | 1/685 | |
| Z86 | TSS463 | EFR Dynamic Life Test | 12h | Estimated | 65 ppm |
| | | LFR Dynamic Life Test | 500h 1000h | | 3.9 fit |
| Z86 | TSS461C | EFR Dynamic Life Test | 12h | Estimated | 49 ppm |
| | | LFR Dynamic Life Test | 500h 1000h | | 2.9 fit |
| | | Failure mechanisms | All | 50% 17% 17% 17% | Poly silicide defect metal resistor shift bonding |

| | | | | | |
|--------|--------------|--|----------------------|-------------------|---|
| Global | All products | EFR Dynamic Life Test LFR Life Test | 12h 500h 1000h | 4/28097 2/1840 | 165 ppm (20mm ²) 10 fit (20mm ²) |
|--------|--------------|--|----------------------|-------------------|---|

4.4 Package Qualification

This section presents TSS463 and TSS461C package qualification results, including additional measurements intending to fulfil Q100 Automotive Standard requirements.

| Lot Number | Device Type | Test Description | Step | Result | Comment |
|------------|----------------------|--|---|---|--|
| Z21538F | TSS463 in SO 16 (1) | Thermal Cycles 85/85 Humidity Resistance to Soldering Heat HAST after Soldering Stress (with 5.5v bias) | 1000c 2000c 1000h 2000h Level 1 Level 3 168h | 0/45 0/45 0/45 0/45 1/10 0/10 0/45 | 1 die top delamination |
| Z21997A | TSS463 in SO 16 (2) | Thermal Cycles 85/85 Humidity HAST after Soldering Stress 165c HT Storage Physical Dimensions Bonding Destructive Tests (4) Resistance to Soldering Heat | 500c 1000c 500h 1000h 168h SAM 500h 1000h Visual WP BS Level 1 Level 2 Level 5 | 0/45 0/45 (3) 0/45 0/45 (3) 0/45 (3) 0/10 0/45 0/45 0/5 0/30 (5) 0/30 0/10 0/10 0/10 | AVG=77.3 STD=8.9 CPK=1.8 MAX=98.9 MIN=61.1 AVG=17.4 STD=1.5 CPK=2.3 MAX=21.1 MIN=14.3 |
| W28184C | 29C461B in SO 24 (1) | Thermal Cycles 85/85 Humidity HAST after Soldering Stress | 500c 1000c 500h 1000h 168h | 0/45 0/45 0/45 0/45 0/45 | |
| Z04948C | TSS461C | Thermal Cycles 85/85 Humidity HAST after Soldering Stress HAST 5.5V | 500c 1000c 500h 1000h 168h 168h 336h | 0/45 0/45 0/45 0/45 0/45 0/45 0/45 | |

| Lot Number | Device Type | Test Description | Step | Result | Comment |
|------------|-------------------------|--|---|---|---------|
| Z20569K | HMT-65664A in SO 28 (2) | Thermal Cycles 85/85 Humidity Resistance to Soldering Heat Marking Permanency HAST after Soldering Stress (with 5.5v bias) | 500c 1000c 500h 1000h 2000h Level 1 - 168h | 0/45 0/45 0/45 0/45 0/45 0/10 0/3 0/45 | |

| | | | | | |
|--------|--------------|---|--------|--------------------|------------------|
| Global | All products | Mounting Stress level 1 Climatic Tests | Elect. | 0/255 0/720 | 0 ppm 0 % |
|--------|--------------|---|--------|--------------------|------------------|

Notes:

- (1) SUMITOMO 6300 molding compound
- (2) NITTO MP8000 molding compound
- (3) Electrical test with Quality program at 25°C, 125°C and -40°C
- (4) Performed on molded device opened using acid
- (5) No Lifted Ball Bond, breakdown observed on wires (83%) and over the stich (17%)

Qualpack TS80C31X2/C32X2

4.5 Device Qualification

This section presents TSS463 and TSS461C device qualification results, including additional measurements intending to fulfil Q100 Automotive Standard requirements.

| Lot Number | Device Type | Test Description | Step | Result | Comment |
|------------|---------------------|-----------------------|---------------|---------------------|-----------------|
| Z21538F | TSS463 in SO 16 | EFR Dynamic Life Test | 12h | 0/261 | |
| | | LFR Dynamic Life Test | 500h 1000h | 0/116 0/116 | |
| Z21997 | TSS463 in SO 16 | EFR Dynamic Life Test | 12h 48h | 0/800 0/304 | |
| | | LFR Dynamic Life Test | 500h 1000h | 0/45 0/45 (6) | |
| W28184C | 29C461B in SO 24 | EFR Dynamic Life Test | 12h | 0/298 | |
| | | LFR Dynamic Life Test | 500h 1000h | 0/72 0/72 | |
| Z04948C | TSS461C in SO 24 | EFR Dynamic Life Test | 12h | 0/296 | |
| | | LFR Dynamic Life Test | 500h 1000h | 0/78 0/78 | |
| Global | All products | EFR Dynamic Life Test | 12h | 0/1655 | 0 ppm measured |
| | | LFR Dynamic Life Test | 500h 1000h | 0/311 0/311 | 18 fit measured |

Notes:

(6) Electrical test with Quality program at 25°C, 125°C and -40°C

4.5.1 ESD and Latch-up results

| Lot Number | Device Type | Test Description | Step | Result | Comment |
|------------|---------------------|-------------------------|---|-------------------------------------|--|
| Z21538B | TSS463 SO 16 | ESD HBM model | 3000v 4000v 4500v 5000v 1500v | 0/10 1/13 0/4 3/13 0/10 | CLASS 2 Leackage pin 6 Leackages pin 2,6,15 CLASS C6 (EOS/ESD of association) |
| | | ESD CDM model | | | |
| | | Latch up Vcc overstress | 10v | 0/10 | |
| | | LU power injection | 50mW | 0/10 | |
| Z19814 | TSS461C DIL 24.3 | ESD HBM model | 3000v 4000v 1500v | 0/5 3/3 0/4 | CLASS 2 Leakages CLASS C6 |
| | | ESD CDM model | | | |
| | TSS461C | Latch up Vcc overstress | 10v | 0/10 | |
| | | LU power injection | 50mW | 0/10 | |

4.5.2 Failure Mechanisms and Corrective Actions

| Failure Mechanism | Root Cause | Corrective Action | Date | Effect | Check of Efficiency |
|-----------------------|--------------------------------|--|--------|-----------------------------|------------------------------|
| Poly silicide defects | Process conditions | Reduce silicide temperature, increase duration | Nov 97 | Robustness improved | EFR monitoring |
| Die top delamination | Sumitomo630 0 molding compound | Move to Nitto MP8000 | Jan 98 | No more moitures sensitivty | pass level 1 of JESD 22 A112 |

4.5.3 Qualification status

The Wafer Process and the assembly are qualified and controlled by regular monitoring.

The TSS461C VAN is full qualified since 1996 July.

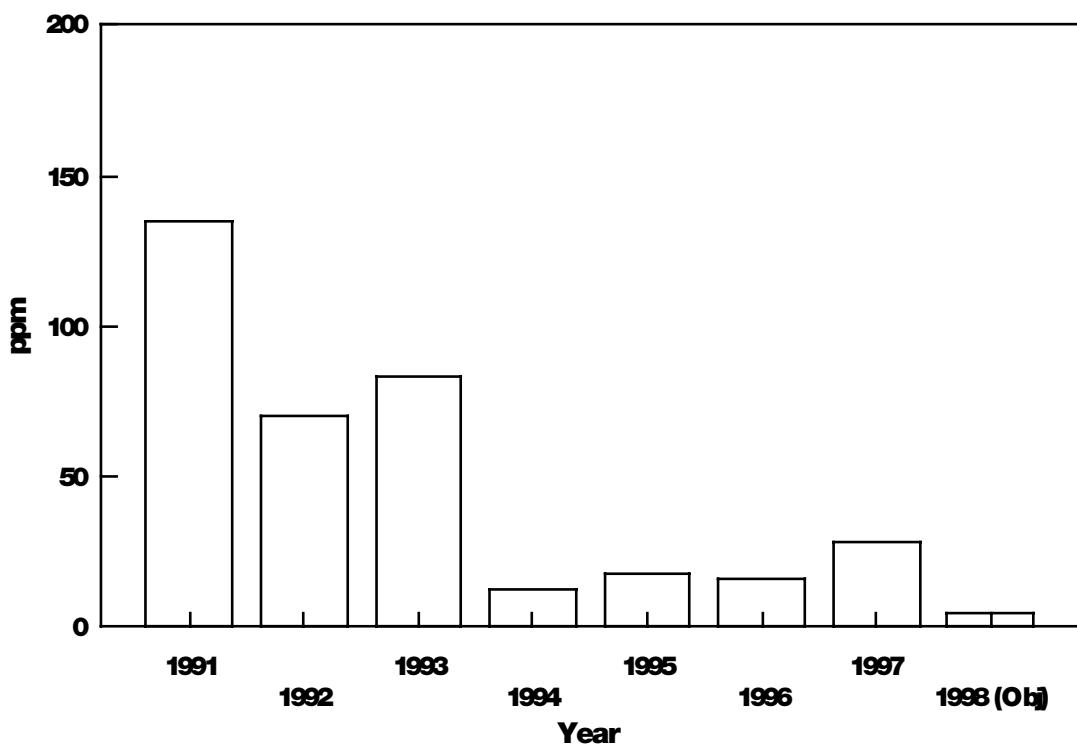
The TSS463 VAN is full qualified since 1997 October.

Additional measurements done in 1998 and generic results demonstrate compliance of the two products to Q100 Automotive Standard.

Outgoing Quality and Reliability

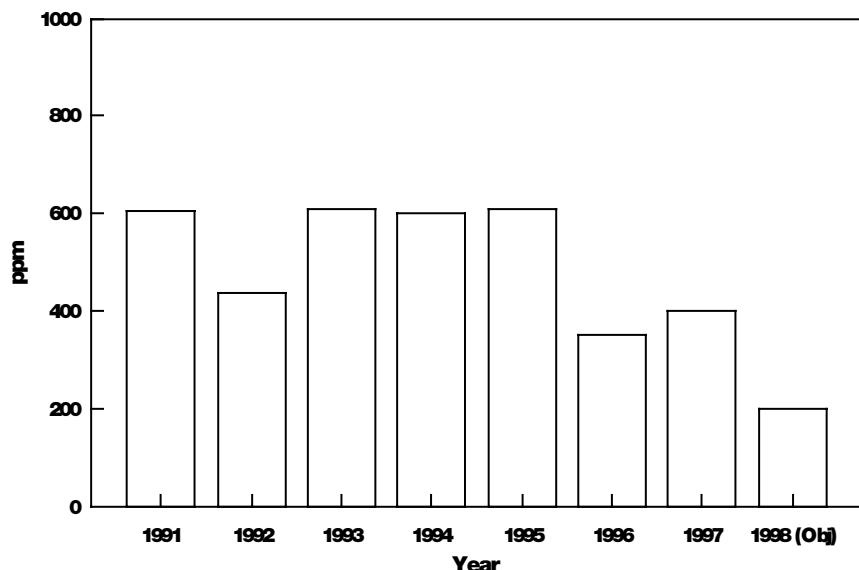
4.5.4 AOQ (Average Outgoing Quality)

The AOQ is measured following 100% test by sampling outgoing product. The results of this inspection are recorded in ppm (parts per million) using the method defined in JEDEC 16. The figures below cover the last years for both the subject and structurally similar products.



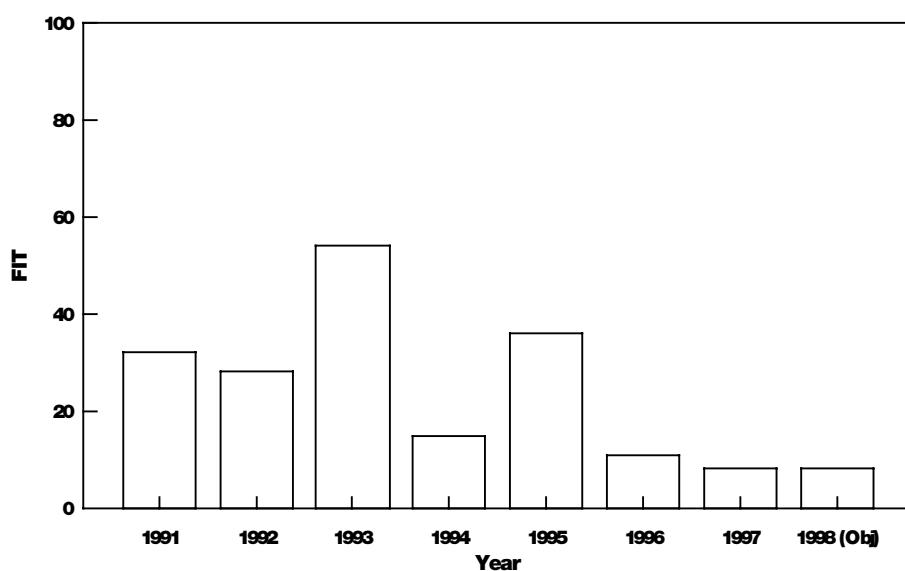
4.5.5 EFR (Early Failure Rate)

The EFR is measured on a sample of devices by operating them at an elevated temperature and measuring the number which fails to meet specification after 12 hours at 150°C. The figure is expressed in terms of ppm.



4.5.6 LFR (Latent Failure Rate)

The LFR is measured by operating devices at elevated temperatures for 1000 hours and measuring the failure rate. Using the Arrhenius law, the expected failure rate at a operating temperature of 55°C is calculated using an activation Energy of 0.6 eV with a confidence level of 60%. This is expressed in units per billion hours (FIT).



5. User Information

5.1 Soldering Recommendations

For DRY PACKED products, TEMIC recommends to strictly follow the procedure described hereunder:

- Dry packed products must not be stored more than 1 year at 40°C - 90%rh
(worst storage conditions assumed)
- A longer storage period is allowed taking into account the following conditions:
5 years max at 25°C (+/-5°C) - 50%rh
- From opening of the packs, the product must be assembled within 48 hours.
(worst in-process storage condition assumed: 30°C - 60%rh)
- If they cannot be soldered within this time period, then the pieces must be dried at 125°C for 24 hours. Only one drying is allowed.
- Max relative humidity allowed in the bag is 20% (readable on the indicator inside the bag). If this value is reached, then the parts must be dried at 125°C for 24 hours before mounting.
- For high sensitive products, the delay between pack opening and assembly is reduced to 6 hours (Level 6 of JEDEC 22-A112). In this case, a warning printed on each pack advises the user of this restriction .

5.2 DRY PACK Ordering rules

TEMIC qualification procedure allows to classify products according to JEDEC 22-A112 and to determine the convenient conditioning for safe customer use.

Nevertheless, even if the product is not classified as moisture sensitive, it is possible (for example if storage conditions are not properly controlled) to order product with a Dry Pack.

In this case the product name suffix will be ":D" or ":xD".

5.3 ESD caution

The user must protect components against EOS and ESD damages by grounding personal and workstations.

6. Environmental Information

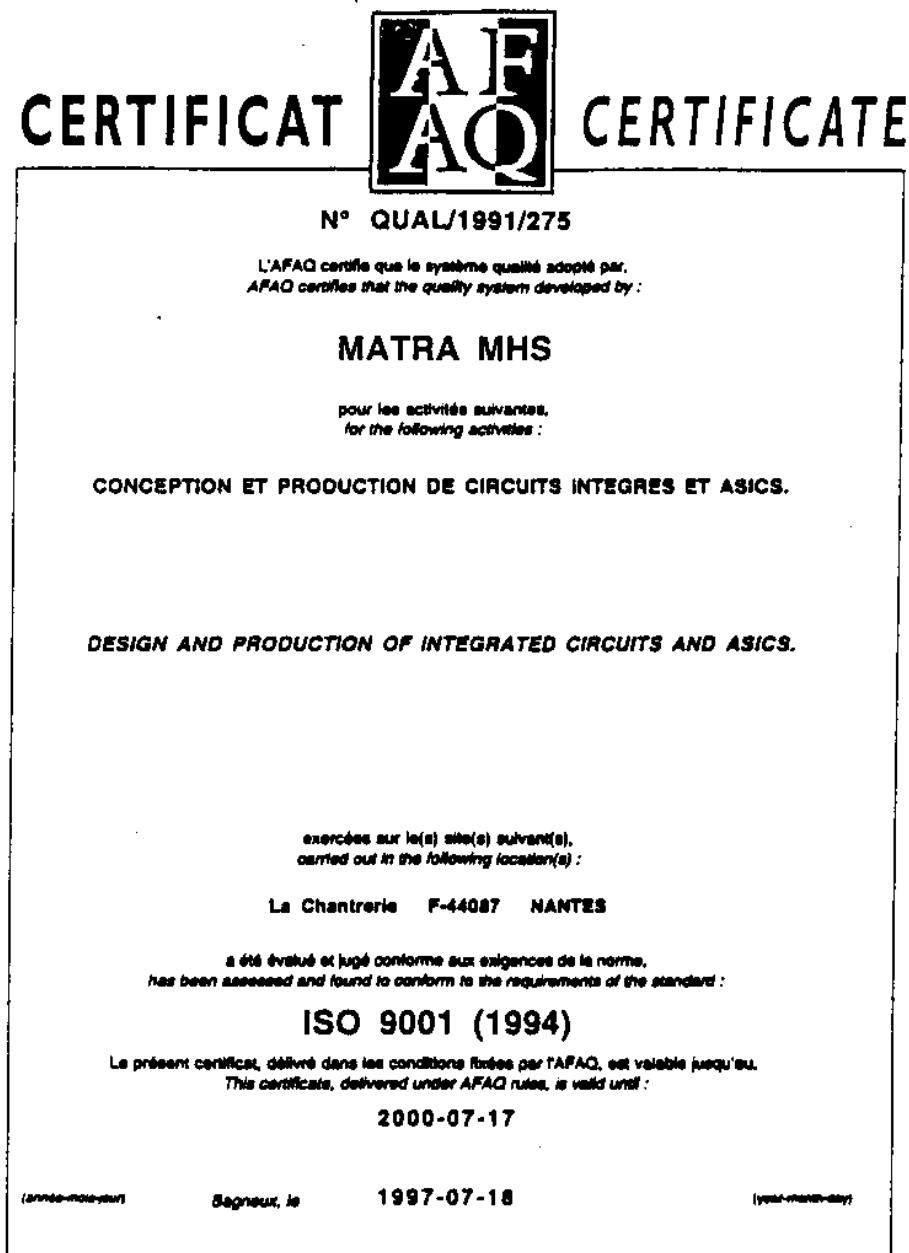
The TEMIC Environmental Policy aims at:

- Reducing the use of harmful chemicals in its processes
- Reducing the content of harmful materials in its products
- Using re-cyclable materials wherever possible
- Reducing the energy content of its products

As part of that plan, Ozone Depleting Chemicals are being replaced either by TEMIC / MHS or its sub-contractor's processes.

7. Other Data

7.1 ISO9001 Approval Certificate



7.2 Databook Reference

Direct access on the web to datasheet at:

<http://www.temic-semi.com>

Select: Products
 Automotive ICs
 Multiplex ICs

7.3 Address Reference

All enquiries relating to this document should be addressed to the following:

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Telephone (33) 2 40 18 18 18
Telefax (33) 2 40 18 19 20

Or direct contact same address
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Quality Engineer
Telephone (33) 2 40 18 17 73
Telefax (33) 2 40 18 19 00

8. Revision History

| Issue | Modification Notice | Application Date |
|--------------|---|-------------------------|
| 0 | TSS463 VAN Qualification Report | 1997 October |
| 1 | Qualpack TSS463 Van | 1998 February |
| 2 | Qualpack TSS463 and TSS461C VAN CONTROLLERS | 1999 January |
| | | |

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